



What is a circular economy (CE)?

- [Why is there a need?]
- [Are there definitions of CE?]

Is there a policy context and driver for CE?

- [What is the European Commission doing on CE?]
- [What are UK government(s) doing on CE?]

Are there non-governmental drivers for CE?

What will the Green Construction Board Circular Economy Working Group focus on?

- [What is the Green Construction Board (GCB)?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB CE Group aim to achieve?]
- [What is the scope of the GCB Circular Economy Working Group?]
- [How will the group function?]
- [Has the GCB done any previous work relating to construction waste and resource efficiency (material and water)?]

What are/might be the business benefits of applying CE thinking to construction and the built environment?

- [Has anyone tried to quantify the economic benefits of applying CE thinking to construction and the built environment?]
- [Are there other business benefits to CE Thinking?]

What are likely to be the challenges for CE thinking in the built environment?

What approaches are already happening in the built environment world that contribute to a Circular Economy?

- [What is happening in the design community?]
- [What is happening in the manufacturing sector?]
- [What is happening in the contracting community?]
- [What is happening in the engineering community?]
- [What is happening during the refurbishment and end of life stages?]
- [Are construction products and materials being reused?]

Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist relating to the circular economy?]
- [Are there existing standards in construction that are evolving to cover circularity issues?]
- [What is the role for BIM – Building Information Modelling?]

Construction and Demolition Waste (CDW) – Measuring, understanding and eliminating it?

- [How much construction and demolition waste is produced in the UK?]
- [How much CDW data collected?]
- [How much CDW is recovered?]
- [How much CDW goes to landfill?]
- [How many materials are reclaimed?]

Are there any examples of CE happening in the built environment?

- [Examples of CE thinking in construction]
- [Examples of CE thinking in the built environment]
- [Research projects on CE thinking relevant to construction]

Why is there a need?



Circular economy thinking means maintaining access to materials and resources for continual and future use. With an ever expanding human population and rising standards of living across the globe, it is likely to be the only viable option to maintain standards of living.

- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
- [Do waste regulations need to evolve to enable CE application?]
- [What are the Research and innovation challenges?]

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- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist for measuring CE?]

Is there a policy context?

- [What is the European context?]
- [What are UK government policies?]

Are there non-governmental organisations?

What will the Green Construction Board do?

- [What is the Green Construction Board?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB Circular Economy Working Group do?]
- [What is the scope of the Circular Economy Working Group?]
- [How will the group fit into the construction industry?]
- [Has the GCB done any work on construction waste and water?]

What are/might be the challenges of applying CE thinking to the built environment?

- [Has anyone tried to apply CE thinking to the built environment?]
- [Are there other business models?]

What are likely to be the challenges of CE thinking in the built environment?

- [What are the Research and innovation challenges?]

Are there definitions of CE?



Yes, there are a number of differing definitions and views of CE. Popular ones are:

- Ellen MacArthur Foundation which has produced a series of in-depth think tank pieces, including a definition of CE, an indicator for measuring CE and detailed consideration of the business case for CE. <http://www.ellenmacarthurfoundation.org/circular-economy>
- A number of organisations have adopted their own definitions of circular economy. Whilst these vary to an extent, they include common aspects such as keeping materials at a highest value possible, having circular loops of materials and developing appropriate business models. Examples include WRAP (<http://www.wrap.org.uk/content/wrap-and-circular-economy>); The Scottish Government (<https://consult.scotland.gov.uk/zero-waste-delivery/making-things-last>), Green Alliance <http://www.green-alliance.org.uk/CETF.php> ; Aldersgate Group (<http://www.aldersgategroup.org.uk/asset/download/242/Report%2520-%2520Resilience%2520in%2520the%2520Round.pdf>), Chatham House (https://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%20Environment%20and%20Development/bp0312_preston.pdf).
- The concept of CE is a vibrant subject area in the academic community involving various schools of thought such as cradle to cradle, performance economy, industrial ecology and biomimicry.
 - E.g. The Industrial Society <http://www.is4ie.org/> ; the 2005 conference on Industrial Ecology for a Sustainable Future <http://www.is4ie.org/resources/documents/abstractbook-oral%20050603.pdf> and the Industrial Ecology Gordon Research Conference <https://www.grc.org/programs.aspx?id=12729>; as well as editions of academic journals. E.g. Journal for Industrial Ecology <http://jie.yale.edu/cfps> and the Proceedings of the Institution of Civil Engineers – Waste and Resource Management <http://www.icevirtuallibrary.com/toc/jwarm/current>
- Of course, CE as a concept builds on a mountain of themes relating to waste reduction, recycling, reuse, material efficiency, security of supply, sustainable consumption and production, better design, sharing of resources etc. All these are strands of circular economy thinking.

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- [What is the European Context?]
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Are there non-governmental drivers for CE?

What will the Green Construction Board (GCB) do?

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- [What will the GCB CE Group do?]
- [What is the scope of the GCB CE Group?]
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What are/might be the barriers to applying CE thinking in the built environment?

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- [What are the Research and innovation challenges?]

What is the European Commission doing on CE?



- The European Commission in December 2015 adopted a new Circular Economy Package to stimulate Europe's transition towards a circular economy; it is intended to boost global competitiveness, foster sustainable economic growth and generate new jobs. http://europa.eu/rapid/press-release_IP-15-6203_en.htm
- The Netherlands holds the EU Presidency from January to June 2016. It intends to finalise actions to implement the EU Circular Economy package by June 2016. <http://english.eu2016.nl/>
- The Government of the Netherlands has produced a knowledge map for the Circular Economy, from which this report takes its inspiration. <http://www.circle-economy.com/news/knowledge-map-circular-economy/>
- The European Environment Agency (EEA) will contribute to the knowledge base on circular economy by developing a comprehensive analytical framework by which to better understand it and to measure progress. Its first report *Circular economy in Europe - Developing the knowledge base* was published in January 2016. It looks at four aspects: the concept and benefits, the main enabling factors and transition challenges, metrics for measuring progress and contextual issues that requiring research or policy. <http://www.eea.europa.eu/publications/circular-economy-in-europe>
- Europe 2020 is the EU's Growth Strategy and includes major strands of work including a Resource Efficient Europe which underpins thinking on the wise use of resources. <http://ec.europa.eu/resource-efficient-europe/>
- A strand of the Resource Efficiency Roadmap led to an EU Communication on Resource Opportunities in the Building Sector. <http://ec.europa.eu/environment/eussd/pdf/SustainableBuildingsCommunication.pdf>
- This is being taken further forward in a 2015-17 research project by the Commission to identify macro-objectives for resource efficient buildings. http://susproc.jrc.ec.europa.eu/Efficient_Buildings/docs/151222%20Resource%20Efficient%20Buildings_Macro%20objectives%20WP_Final%20version.pdf

construction that are
[What are the
[What is Building Information Modelling?]

Construction Waste (CDW) –
and eliminating it?
[What is the impact of construction and demolition waste

[How much waste goes to landfill?]
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What CE is happening in the
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What are UK government(s) doing on CE?



- The government response to the EU 2015 consultations on its Circular Economy package are available. Defra is the policy lead for the CE and is holding discussions with stakeholders to feed into EU negotiations and plans. <https://www.gov.uk/government/publications/circular-economy-and-waste-markets-uk-government-response-to-european-commission-consultations>
- The Scottish government has published a consultation on creating a more circular economy in Scotland (August 2015). <https://consult.scotland.gov.uk/zero-waste-delivery/making-things-last>
- Wales - The Environment (Wales) Bill will put in place the legislation needed to plan and manage Wales' natural resources in a more proactive, sustainable and joined-up way. <http://gov.wales/topics/environmentcountryside/consmanagement/natural-resources-management/environment-bill/?lang=en>
- The Government / industry **Green Construction Board (GCB)** has endorsed a working group on the circular economy to provide leadership to the construction industry to start to move towards more CE thinking.

Construction and Demolition Waste (CDW) – Understanding and eliminating it?

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Examples of CE happening in the built environment?

- [Are there any examples of CE thinking relevant to construction?]

- [How can we measure the circularity of their materials/products within the economy?]
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The Green Construction Board

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Are there non-governmental drivers for CE?



Yes, many think tanks, industries, companies, professional institutions, trade associations and NGOs are pushing forward with CE thinking as they understand the need to change our consumption patterns.

- The Ellen MacArthur Foundation has been a major player in driving understanding of the necessity and benefits of a Circular Economy. <http://www.ellenmacarthurfoundation.org/circular-economy>
- The World Economic Forum has started an initiative with the Ellen MacArthur Foundation called Project MainStream aimed at accelerating the transition to a circular economy. It has launched three new programs focused on developing ways of scaling the circular economy through materials management, information technology and business model innovation. <http://www.weforum.org/global-challenges/projects/circular-economy/>
- The London Waste and Recycling Board is developing a circular economy route map for London with the built environment identified as one of five focus areas. http://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report_web_09.12.15.pdf (p21-22 for built environment)
- The Royal Society of Arts (RSA) runs a programme called *Great Recovery: redesigning the future* aimed at promoting circularity in thinking. <http://www.greatrecovery.org.uk/>
- Many industry and business organisations and companies are exploring what CE thinking means for them, including security and scarcity of raw materials, and examining the challenges and opportunities their sector faces. E.g. Gypsum to Gypsum <http://gypsumtogypsum.org/>

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What is the Green Construction Board (GCB)?



The Government/industry Green Construction Board (GCB) is the Sustainability work stream of the Construction Leadership Council. The role of the GCB is to provide leadership and action to enable the whole value chain (clients, contractors, product manufacturers and suppliers) to deliver more environmentally sustainable outcomes, and be more productive and better placed to exploit the growing global market.

<http://www.greenconstructionboard.org/>

Construction and Demolition Waste (CDW) – measuring, understanding and eliminating it?

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What is the GCB Circular Economy Working Group? ❌

This is a working group of the government / industry Green Construction Board and its remit is to promote CE thinking into the construction sector.

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- [Examples of CE thinking in the built environment?]
- [Are there any projects on CE thinking relevant to construction?]

- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
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What are/might be the business cases for applying CE thinking to construction in the built environment?

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Measuring and Managing Information for the Circular Economy

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- [Building Information Modelling?]

What is the scope of the GCB Circular Economy Working Group?



This is still being discussed, acknowledging that there are many initiatives looking at a whole range of topics, some in considerable depth. It is not the intent of the GCB to duplicate what is already happening but to help catalyse action by organisations, companies and individuals. The Group will look at:

- Buildings, infrastructure and materials/products
- But the Group will not cover renewable or clean energy, energy efficiency, carbon reporting or sharing assets such as buildings – because there are many other initiatives and organisations that are focused on these topics

Construction and Demolition Waste (CDW) – Reducing and eliminating it?

- [How much CDW is generated in the UK?]
- [How much CDW is recycled?]
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- [How much CDW is reclaimed?]

What are the business cases for CE thinking in the built environment?

- [What are the business cases for CE thinking relevant to construction?]

- [What business models are required?]
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Has the GCB done any previous work relating to construction waste and resource efficiency (materials and water)?



Yes, a project from 2007 to 2013 developed a methodology for measuring construction, demolition and excavation waste (CD&E) to landfill, as well as annual reporting. The group also developed an action plan. <http://www.greenconstructionboard.org/index.php/resources/greening-the-industry/top-tips/waste?id=401>

The material sector produced a series of sector Resource Efficiency Action Plans (REAPs), advanced understanding of embodied impact information and with BRE and BSI developed responsible sourcing standards schemes and standards.

Water: contractors and manufacturers produced guidance on water usage in the manufacturing and construction processes. <http://www.greenconstructionboard.org/index.php/resources/greening-the-industry/water-management-planning/introduction>

and

<http://www.constructionproducts.org.uk/publications/technical/display/view/water-efficiency-the-contribution-of-construction-products/>

- [What business models are required?]
- [Do waste regulations need to evolve to enable CE application?]
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Demolition Waste (CDW) – standing and eliminating it?

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Has anyone tried to quantify the economic benefits of applying CE thinking to construction and the built environment?



- The EU Circular Economy package does not mention the built environment specifically but quantifies the adoption of a circular economy in Europe as bringing net savings of 600 billion euros of pr. http://europa.eu/rapid/press-release-MEMO-15-6204_en.htm
- The Ellen MacArthur Foundation/McKinsey Growth Within Report states that says around £60 billion of net savings of primary resources could be made by 2030. <http://www.ellenmacarthurfoundation.org/publications>
- The London Circular Economy Report calculates that CE opportunities in the built environment will add £3-5bn to GDP by 2036. <http://www.lwarb.gov.uk/what-we-do/accelerate-the-move-to-a-circular-economy-in-london/>
- Resource efficiency savings (waste-related) could be in the region of £2.39m annually to UK construction businesses <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=2&ProjectID=16943>

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Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist relating to the circular economy?]

Are there other business benefits to CE Thinking?



- Security of Supply. The EU has produced a study on the security of supplies and scarcity of raw materials. <http://eplca.jrc.ec.europa.eu/uploads/RawMat-scarcity-of-raw-materials.pdf>
- The UK Government (Defra and BIS) published a study in 2012 entitled a Resource Security Action Plan: Making the most of valuable materials. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69511/pb13719-resource-security-action-plan.pdf
- Understanding the business risk of availability and price of materials in a world of limited supply and increasing competition, is part of the circular economy debate.
- Future proofing of business activities, such as investigating the effect of business models compatible with CE thinking and building business resilience in the CE area.
- Is there a competitive advantage to being an early adopter of CE thinking?

application?]

- [What are the Research and innovation challenges?]

What is a circular economy (CE)?

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What approaches are already happening in the built environment world that contribute to a

Measuring and Managing Information for the Circular Economy



What are likely to be the challenges for CE thinking in the built environment?

Much of the work to develop CE thinking to date has been focused on short-lived consumer goods such as phones, computers, washing machines etc. But can this thinking also be applied to buildings and infrastructure that exist for decades if not centuries. Examples of the reuse of buildings or construction materials and products litter the millennia, but how can modern buildings and modern materials be designed to be better used, last longer and be available for similar or alternate purposes at end of life. The challenges for adapting CE thinking in construction are likely to be complex and include:

Products, buildings and infrastructure:

- Long life of buildings, infrastructure and products.
- Complexity of buildings.
- Variable lifespans of components of buildings.
- Existing, especially more recent, buildings are not designed for today's End of Life issues.
- Changes in specification and technology over time mean that many products may become redundant in future.

Recovery of products/materials:

- Often a low commercial value of materials/products (apart from metals) at demolition.
- Lack of widespread secondary market mechanisms.

- Problematic logistics of moving and storing materials.
- Constraints of existing waste legislation.
- Complex materials and products which are increasing in use can be difficult to reuse.
- Lack of extended user responsibility requirements.
- Changes in legislation may mean that recovered material no longer complies with certain regulations e.g. REACH.

Business considerations:

- Value of adopting CE practices.
- Use of discount rates can effectively mean the value of recovered materials in 20 years' time can be zero.
- Most companies will build in depreciation so the value of products in the future are written off.
- Viable business models e.g. leasing products as a service may only be relevant to short-lived products such as lights and carpet tiles.
- Ownership of resources (IP), testing, warranties, guarantees etc of reused, reclaimed products.

Other considerations:

- Understanding life cycle thinking to aid complex decisions, e.g. delivering lower carbon in performance but creating end of life issues? Or the opposite, creating good end of life possibilities but increasing carbon emissions in the process.
- A potential disconnect between developer and constructor, freeholder or leaseholder and occupant make keeping track and benefiting from CE over a building lifecycle difficult.
- Applying systems thinking (i.e. the whole supply chain working together).
- Measuring circularity for complex long-lived buildings and infrastructure made of multiple products and materials.
- Information management and data needs – what information is needed, when is it needed to make informed decisions, who needs this information and in what format.
- Engaging SME businesses.

What is a circular economy (CE)?

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What approaches are already happening in the built environment world that contribute to a Circular Economy?

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- [What are UK government policies?]

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What are likely to be the challenges for CE thinking in the built environment?

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What is happening in the design community?

There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.

- Whilst many buildings/infrastructure projects are designed with sustainability principles and may incorporate aspects of circular economy there are few examples as yet, of the 'full' application of circular economy thinking.
- A reasonably high level of understanding of the generic principles of designing for deconstruction exist (but there seems little commercial appetite for doing it).
- Building rating schemes such as [BREEAM](http://www.breeam.com/) <http://www.breeam.com/> ; LEED <http://www.usgbc.org/leed>; CEEQUAL <http://www.ceequal.com/>; and Ska <http://www.rics.org/uk/knowledge/ska-rating-/>, address some elements of circular economy such as diverting waste from landfill, reuse of products and designing out waste.
- The British standard BS995 Part 1 and 2 has been written to address material efficiency at the design stages of buildings. <http://shop.bsigroup.com/ProductDetail/?pid=000000000030258602> and <http://shop.bsigroup.com/ProductDetail/?pid=000000000030296208>
- The Royal Society of Arts (RSA) runs a programme called *Great Recovery: redesigning the future* aimed at promoting circularity in thinking, though as yet it does not have a focus on construction or buildings. <http://www.greatrecovery.org.uk/>



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What is happening in the manufacturing sector?



- Many manufacturers recycle their production waste back into their processes.
- There are a number of take back schemes for surplus materials and offcuts as well as packaging such as pallet reuse. This includes for plasterboard, ceiling tiles, mineral wool insulation, bricks and blocks.
- A number of sectors have produced Resource Efficiency Action Plans (REAPs) (<http://www.constructionproducts.org.uk/index.php?id=1658>) and are now looking at the challenges and opportunities of the circular economy. Examples include the Gypsum to Gypsum project (<http://gypsumtogypsum.org/>) and PaintCare UK (<http://www.paintcare.org.uk/>)
- Some sectors are looking at reuse of their products, e.g. Innovate UK is funding several research projects looking at the reuse of steel. https://connect.innovateuk.org/web/sustainabilityktn/article-view/-/blogs/innovate-uk-projects-on-circular-economy-in-the-built-environment-sector?_33_redirect=https://connect.innovateuk.org/web/sustainabilityktn/overview?p_p_id=101_INSTANCE_ghKKWlt6630Q&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=5
- Some sectors have well established recycling schemes such as Recovynl and Carpet UK. http://www.carpetrecyclinguk.com/find_a_recycler_near_me.php
<http://www.recovynl.com/>
- Life cycle thinking is well established and can be considered a mature approach for understanding environmental impacts, initially due to the BRE Green Guide <https://www.bre.co.uk/greenguide/podpage.jsp?id=2126> and now with the more recent adoption of the European standards on measuring and reporting the sustainability performance of construction works and construction products (CEN 350 and EN 15804). <http://www.constructionproducts.org.uk/publications/technical/display/view/a-guide-to-understanding-the-embodied-impacts-of-construction/>
- Many companies and sectors have developed sustainability plans, with targets, indicators and reporting with elements of relevance to circular economy thinking. E.g. Hanson, <http://www.hanson.co.uk/en/sustainability>; Marshalls <http://www.marshalls.co.uk/about-sustainability> and the Mineral Products Association <http://www.mineralproducts.org/sustainability/>
- The CBI will publish a UK Minerals Strategy in 2016. This follows on from a report on the Future of Our Materials <http://www.ukmineralsforum.org.uk/downloads/The-Future-of-our-Minerals-UKMF-Nov-2014.pdf> and an Overview of the Mineral Extraction Industry http://www.british-aggregates.co.uk/documentation/doc138_CBI_UK_Mineral_Extraction_Industry.pdf.
- The Construction Products Association, the umbrella trade association for UK-based manufacturers and distributors, provides leadership and learning to help catalyse thinking and action by its members on circular economy and broader sustainability and technical issues. <http://www.constructionproducts.org.uk/publications/technical/>

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Measuring and Managing Information for the Circular Economy

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What is happening in the engineering community?



ICE, the Institution of Civil Engineers, has a waste and resource management panel which includes circular economy in its deliberations. It intends to produce a special edition of its proceedings on the subject of the circular economy in the built environment. The closing date for submission of articles is 29.02.16.
<http://www.icevirtuallibrary.com/toc/jwarm/current>

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- [Building Information Modelling?]

What is happening during the refurbishment and end of life stages?

- The demolition industry recovers much of the waste that is produced at end of life, but a large proportion may be downcycled. In 2012, the National Federation of Demolition Contractors (NFDC) members reused or recycled 94% of demolition waste <http://demolition-nfdc.com/news/posstat.html>
- The National Federation of Demolition Contractors (NFDC) has produced a series of 'Demolition and Refurbishment Information Sheets (DRIDS) to encourage the industry to reuse and recycle materials wherever possible. <http://demolition-nfdc.com/page/drids.html>
- The European Demolition Association (EDA) has a working group on recycling and have produced a report on the state of the demolition industry, which also covers pre-demolition audits. <http://www.europeandemolition.org/communication/news/undersatanding-european-demolition-industry>

Demolition Waste (CDW) – Handling and eliminating it?

- [How much construction and demolition waste is produced in the UK?]
- [How much is reused?]
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Are construction products and materials being reused?



- An established Reclamation industry exists, particularly for high value architectural products such as stone, parquet flooring, fireplaces etc. <http://www.salvo.co.uk/>
- WRAP produced a [Guide to procuring reclaimed building products](http://www2.wrap.org.uk/downloads/Reclaimed_building_products_guide.7776e163.5259.pdf). http://www2.wrap.org.uk/downloads/Reclaimed_building_products_guide.7776e163.5259.pdf
- Material exchanges are springing up such as Recipro <http://www.recipro-uk.com/>; Construction Material Exchange <http://cme.resourceefficientscotland.com/>; Enviromate <http://enviromate.co.uk/> and Trade Leftovers <http://www.tradelleftovers.com/>
- Community Reuse schemes are growing in number, though they can struggle if based on a sponsorship model. Examples include Community Wood Recycling <http://www.communitywoodrecycling.org.uk/>; Reuseful UK <https://www.scrapstoresuk.org/>; Community Repaint <http://www.communityrepaint.org.uk/> and Furniture Reuse Network <http://www.frn.org.uk/>

Construction and Demolition Waste (CDW) – Reducing and eliminating it?

- [How much CDW is generated in the UK?]
- [How much CDW is recycled?]
- [How much CDW goes to landfill?]
- [How much CDW is reclaimed?]

Examples of CE happening in the built environment

- [Examples of CE thinking relevant to construction]

What business models are required?

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- [Are there other business cases?]

What are likely to be the challenges for CE thinking in the built environment?

- [What are the barriers to CE thinking in the built environment?]
- [What are the Research and innovation challenges?]

What mechanisms and initiatives are taking place to divert construction and demolition waste from landfill?

- The Landfill Tax in the UK, is a key fiscal measure that has encouraged the avoidance of waste to landfill. <https://www.gov.uk/green-taxes-and-reliefs/landfill-tax>
- There has been much funding from organisations such as Innovate UK, WRAP and EPSRC to increase the recovery of wastes, including construction and demolition.
- A number of material focused organisations, as well as the waste industry, continue to undertake work on developing recycling routes for construction and demolition waste. For example, Carpet Recycling UK <http://www.carpetrecyclinguk.com/> and Composites UK <https://compositesuk.co.uk/>
- The waste industry and in particular waste transfer stations are becoming ever more efficient at managing waste.
- The Environment Agency has an End of Life Committee to assess when a waste product can be deemed no longer a waste but a new resource and thus not subject to waste regulations for storage, transport and disposal.



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[What is the role of Building Information Modelling?]

Construction and Demolition Waste (CDW) –
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Are there any examples of circular economy business models being used in the built environment sector?

- There are few examples, though business models are beginning to emerge which focus on relatively short-lived products such as carpet tiles, lighting and mechanical and electrical equipment.



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What needs to happen next to deliver CE thinking in the built environment sector?



This is very much the focus of the Green Construction Board Circular Economy Working Group: how to help catalyse the practical action to deliver the business benefits that are predicted with circular economy thinking. Possible questions might include (but will be evolved / replaced / abandoned during discussions at the GCB/CEG 12 Feb 2016 workshop):

- [What can manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
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How can CE thinking be promoted in the client community?



- Has the economic case been made to convince clients to adopt CE thinking in their projects?
- What is needed to change the demand of the client community?

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What is a circular economy (CE)?

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What is required to facilitate the design community to adopt CE thinking?



- Are there suitable design tools and information to facilitate designing for circularity including deconstruction?
- Are there existing lesson learning?
- Can the demolition industry provide advice?
- What needs to be done to shift theory to practical action?
- Does infrastructure need different tools than buildings?
- Which organisations will lead on transitioning to this thinking?

Construction and Demolition Waste (CDW) – Understanding and eliminating it?

- [How much construction and demolition waste is generated in the UK?]
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What does procuring with CE thinking in mind look like?

- What needs to be thought about and asked for?
- What issues can be practicable addressed? It is more than just recycled content and recyclability.
- What information do procurers need, in what format and when to make choices?



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What measurement and information management tools are needed?

- What already exists that is helpful and to whom? – Circularity Indicator, CEN 350, EN15804, BIM etc.
- Do existing measurement methodologies need revising, adapting?
- How will data and information be managed?
- What is the future role of BIM and digital asset management in the context of CE?
- What else is needed?



construction that are
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What is required to enable the flow of materials?



- How do we develop technical solutions for products that are currently difficult to recover?
- How do we ensure that material flows continue at the highest value possible?
- What technologies do we need to separate complex products and buildings?
- Do we need to develop viable market mechanisms for secondary materials?

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What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?



- Can the same performance be delivered with less, or different material, through better design?
- Can more use be made of secondary materials in a product's manufacture without increasing the environmental impact?
- Do technologies such as 3D printing enable more bespoke and less wasteful products?
- Does the design stage for the product consider end of life issues?
- Will extended producer responsibility have a part to play?
- Is it logistically and financially viable to set up take back schemes – surplus, offcuts and at end of life?
- What role does packaging play in the CE?

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What business models are required?



- Leasing is an option but how widespread is its application for long lived products and buildings?
- Are issues of IP, warranties, insurance, testing etc going to be major hurdles to the reality of material and product flows?

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What are the Research and innovation challenges?



- What new knowledge and practical demonstration is needed to advance a circular economy for the construction sector?
- What pieces of research are needed which could turn a barrier into a hurdle?
- What new innovations have the potential to have a transformative effect on the sector?
 - Examples could include “switchable” adhesive materials with tuneable properties which could deactivate under a particular set of conditions, to allow for disassembly and separation of components; tools for more rapid identification of valuable materials from end-of-life buildings, the modular reuse of functioning parts of a building, new technologies for remanufacturing, novel materials using waste etc.
- What potentially are the main sources of funding for research into circular economy thinking in construction?
 - Innovate UK. <https://www.gov.uk/government/organisations/innovate-uk>
 - EPSRC – the Engineering and Physical Sciences Research Council. <https://www.epsrc.ac.uk/>
 - The EU’s Horizon 2020 Programme. <https://ec.europa.eu/programmes/horizon2020>
 - Obtain information about research competitions through the Knowledge Transfer Network. <http://www.ktn-uk.co.uk/>

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Does a Circularity Indicator exist?

- Yes; the Ellen MacArthur Foundation in collaboration with Granta Design have published a methodology for measuring circularity. http://www.ellenmacarthurfoundation.org/assets/downloads/insight/Circularity-Indicators_Project-Overview_May2015.pdf
- Is it suitable and relevant for construction? Or does it need to be adapted?
 - The published indicator is well suited to short-lived consumer goods and is probably less likely to be useful for long-lived products or buildings.



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Does a formal British, European or international (ISO) standard exist relating to the circular economy?



- The British Standards Institution (BSI) began in 2015 the development of BS 8001 Framework for implementing circular economy principles in organisations. There is no EU or ISO standard or work stream in progress.

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Are there existing standards in construction that are evolving to cover circularity issues?

- CEN 350 is a suite of European standards for measuring the sustainability performance of buildings and construction products and is wrestling with how to measure different end of life scenarios.
- EN 15804 is the methodology for measuring the embodied impacts of construction products and for producing an EPD (an Environmental Product Declaration); it already measures the impact of recycled content and recyclability at end of life and is assessing additional indicators for resource efficiency. Its Module D looks at End of Life of products and is developing ways to calculate the impact of when a product is reused or recycled at End of Life.
- The Belgian Building Research Institute is doing a lot of work to look at end of life scenarios for construction products, looking at recyclability of products, reuse and recycled content and how to measure the related impact. Check wording and weblink.



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What is the role for BIM – Building Information Modelling?



- BIM is the digitalisation of the construction industry. A huge amount of work is going on to develop the systems to manage the information about buildings. The BIM Task Force is leading the work in the UK. <http://www.bimtaskgroup.org/>
- BIM4M2 is the subgroup of the BIM Task Force focused on materials and is preparing the templates that will be required to identify material objects onto which information such as Environmental Product Declaration will hang. <http://bim4m2.co.uk/>

– Building Information Modelling?]

Construction and Demolition Waste (CDW) – Reducing and eliminating it?

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Do we know how much construction and demolition waste (CDW) is produced in the UK?



- Yes; in 2012, in the UK, 45.85 million tonnes of CDW was generated in the UK. Of this amount, 44.8 million tonnes was non-hazardous. http://ec.europa.eu/environment/waste/studies/mixed_waste.htm

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V.1 FEBRUARY 2016

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How is CDW data collected?



- In the UK, CDW data is collected on a yearly basis. It is collected through the environmental protection agencies using waste management data from licensed waste management facilities as well as other sources such as industry data related to recycled aggregates. This may also be supplemented by surveys. Whilst efforts are made to synchronise approaches across England, Scotland, Wales and NI, methodologies are not identical and are under review. http://ec.europa.eu/environment/waste/studies/mixed_waste.htm

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How much CDW is recovered?



- In 2012, of the 44.8 million tonnes of CDW generated, 38.8 million tonnes was recovered, representing a recovery rate of 86.5%. This was calculated in accordance with the EC Waste Framework Directive. http://ec.europa.eu/environment/waste/studies/mixed_waste.htm

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Do we know how much CDW goes to landfill?



- Yes, a methodology was devised by the Strategic Forum for Construction in 2010 and subsequently adopted by the Green Construction Board (both joint industry/government initiatives). http://www.greenconstructionboard.org/otherdocs/Waste_report_4_draft_22-3-10V4.pdf
- This measured construction, demolition and excavation waste (CD&E) to landfill from 2008 to 2012, both in absolute and relative terms to construction output using the ONS data. The baseline in 2008 was 66.5 tonnes of CD&E waste landfilled / £ million construction output, and by 2012 was 119.5 tonnes of CD&E waste landfilled / £ million construction output. The rise was largely due to excavation waste. <http://www.greenconstructionboard.org/images/resources/Report%202023%20Waste.pdf>
- One of the key findings was that annual “Excavation” data can be very variable and rises and falls because of a range of variables including changes in legislation, especially in regard to what is legally allowed to be considered exempt.

Understanding and eliminating CDW –

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Do we know how many materials are reclaimed?



A survey carried out in 2007 estimated that 2.2 million tonnes of material were reclaimed; this is a decrease from 2.97 million tonnes in 1998
http://www2.wrap.org.uk/downloads/BigREc_Survey_report.23bfed0f.10251.pdf

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Buildings:



- Brummen Town Hall <http://www.ellenmacarthurfoundation.org/ce100/directory/royal-bam-group>
- Liander <http://www.rau.eu/>
- Cradle to Cradle inspired buildings <http://epea-hamburg.org/en/content/cradle-cradle-inspired-buildings>
- ICEhouse <http://www.mcdonoughpartners.com/projects/icehouse/>
- Ellen Macarthur Foundation are pulling together examples

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Infrastructure:

- MI-ROG - The Major Infrastructure – Resource Optimisation Group is an initiative with companies in the utilities and construction sectors aiming to eliminate waste and optimise resource reuse across projects and supply chains. The companies involved in MIR-OG include Network Rail, National Grid, Anglian Water, HS2, Thames Gateway, Environment Agency Flood Defence and EDF Energy. <http://www.international-synergies.com/projects/a-highway-to-savings/>



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Materials:

- Creating a Circular Economy for leftover decorative paint in the UK <http://www.paintcare.org.uk/>
- Gypsum to Gypsum <http://gypsumtogypsum.org/>
- Material Sector Resource Efficiency Action Plans (REAPs) - <http://www.constructionproducts.org.uk/index.php?id=1658>
- Take back schemes (manufacturer specific) including
British Gypsum <http://www.british-gypsum.com/about-us/sustainability/plasterboard-recycling>
Siniat <http://www.siniat.co.uk/en/knowledge-centre/sustainability/recycling>
Knauf; Armstrong http://www.armstrong.co.uk/commlgeu/eu1/uk/gb/environment_recycling_program.html
Rockwool, Travis Perkins <http://www.travisperkinsplc.co.uk/news-and-media/our-stories/waste-take-back.aspx>
Kingspan Insulation <http://blog.kingspaninsulation.co.uk/waste-take-back-scheme/>
Recoflor <http://www.recofloor.org/>
Recovynyl <http://www.recovynyl.com/>



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What are the key areas of CE happening in the built environment?

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Research projects on CE thinking relevant to construction



- EU funded 'Buildings as Material Banks' (BAMB) http://cordis.europa.eu/project/rcn/196829_en.html
- EU funded 'Holistic Innovative Solutions for an Efficient Recycling and Recovery of Valuable Raw Materials from Complex Construction and Demolition Waste' (HISER) <http://www.hiserproject.eu/>
- WellMet 2050 <http://www.lcmp.eng.cam.ac.uk/wellmet2/introduction>
- Developing Resource Efficiency Business Models (ReBus) <http://www.wrap.org.uk/content/rebus>
- Innovate UK has funded a number of projects in this area including:
 - A tool to identify and reclaim high value materials at end of life.
 - The reuse of structural steel.
 - The development of a reclaimed wood certification mark
 - Novel materials from waste
 - A design approach to reusable construction components and houses that are adaptable and fully deconstructable at end of life

A full list can be seen on the Innovate UK website.
<https://connect.innovateuk.org/web/sustainabilityktn/article-view/-/blogs/innovate-uk-projects-on-circular-economy-in-the-built-environment-sector?>

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